The USAF Manufacturing Technology

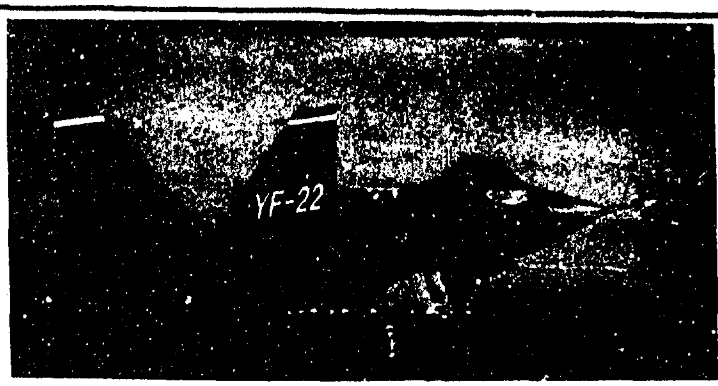
Program Status Report

Spring 1994

WRIGHT LABORATORY
Wright-Patterson AFB, Ohio 45433-7739

MANUFACTURING TECHNOLOGY DIRECTORATE

Inside This Issue



To counter future military threats, the next generation of Air Force fighter aircraft will have to be made from advanced materials to improve weight-to-thrust ratio so it can fly faster. New designs will have to be incorporated for improved maneuverability. The only way to reach these goals is to use state-of-the-art manufacturing technologies to produce components made with the finest and most modern materials.

However, this increase in performance characteristics can no longer come with a higher price tag. Today's budget climate will not support added cost. It is vital that all manufacturing technologies and materials developed to support the next generation fighter aircraft be affordable and reproducible. With these two issues at the forefront, Wright Laboratory's Manufacturing Technology Directorate has awarded four contracts under its Advanced Fighter Initiative.

These four contracts: welded titanium structures, multifunctional radomes, ultra-thin cast structures, and oxidation resistant coating applications, will address the issues of affordability and producibility.

The Advanced Fighter Initiative's strategy will address, in the near term, these two issues to reduce technical and schedule risks of incorporation into superiority edge weapon systems.

For the future, the initiative will combine integrated product process development (IPPD) principles to pursue cost-effective structures. By using these principles, the initiative will address prototype development early in the weapon's life cycle to establish the viability of new design concepts and technologies in a cost-effective manner for low production rates.

More information about these programs starts on the next page.

Project To Improve Manufacturing Of Welded Titanium Structures

A contract recently awarded by Wright Laboratory's Manufacturing Technology (MT) Directorate will examine manufacturing processes to produce welded titanium structures for the advanced fighter aircraft.

The $6 million contract awarded to Boeing Defense and Space Group of Seattle, Wash., will improve the manufacturing technology to produce affordable welded titanium structures. The program's goals are to reduce manufacturing cost and weight.

This project is part of the four-program Advanced Fighter Initiative which addresses affordability and reproducibility issues associated with advanced technologies concerning the advanced fighter aircraft.

"...reduce manufacturing cost and weight of advanced fighter aircraft."

Currently, conventional titanium aircraft structures are difficult and expensive to manufacture because of the extensive fabrication processes required, which includes machining, forging, hot forming, drilling and fastening. Welding will reduce fasteners resulting in a significant cost and weight savings. Welding can also result in reliable, leak-proof joints for fuel cells.

This program will analyze welding and manufacturing processes needed to join welded structural configurations. Complex joint geometries, such as intersecting welds, welding around corners and contour structures are difficult to weld increasing the manufacturing cost and risk. Engineers will investigate existing welding processes and joint designs, and examine what modifications are needed to improve the process, lower the cost, and reduce associated risks.

Boeing will use a three-phased 37-month approach. In the first phase, engineers will assess existing welded designs and processes, identifying the major costs and manufacturing drivers. After this analysis, they will select an existing design as a baseline for cost and weight comparison and then identify potential design and/or manufacturing process changes for cost and risk reduction. Engineers will select welding and manufacturing processes and designs for improvement that have high implementation potential.

Following a detailed process improvement plan, the second phase will demonstrate these improved manufacturing processes and analyze the payoffs in cost, weight, producibility, reliability and quality for implementation.

In the final phase, manufacturing processes showing good payoffs will be demonstrated and will validate the improved designs, processes, controls and fabrication logic.

This program will provide vital information to determine the relationship between welding processes and how to apply them to future aircraft structures to reduce cost and weight while still improving quality.

Project Engineer:
Kevin Spitzer
WL/MTPM
(513) 255-3612

Contract Number:
F33615-93-C-4302

For more information, circle Reader Reponse Number 1

Program To Improve Producibility Of Multifunctional Radomes

Wright Laboratory's Manufacturing Technology (MT) Directorate recently awarded a classified $4.15 million contract to Lockheed Advanced Development Company to improve the manufacturing process for composite multifunctional radomes. The current process is labor intensive and expensive. Many components are handmade. As a result, some do not meet the strict tolerances and testing criteria needed and have to be scrapped.

Lockheed will examine unique fabrication and assembly problems associated with low-radar cross-section radomes. The goals are to establish and validate reproducible and affordable processes for the manufacture of multifunctional radomes which incorporate lightning protection.

To reach their objective, engineers will analyze the manufacturing technology of new low-loss dielectric materials and the extremely tight tolerances for electrical performance requirements. These new processes will be vital to retain radar cross-section performance, structural integrity, and lightning strike protection.

This program will also establish improved inspection methods to achieve low observability characteristics, electrical performance and improved producibility. New materials, product forms and manufacturing techniques will be investigated to allow reproducibility of the radomes.

This three-year, three-phase effort will first establish the materials, product forms and manufacturing processes for the radome. After a complete examination, a preliminary cost benefit analysis will be completed to project cost savings based on the selected design concept, materials and manufacturing processes.

During the second phase, engineers will validate the manufacturing methods by fabricating radome components. Later, a full-scale radome will be constructed and tested.

In the final phase, a limited production run will be performed using the established manufacturing procedures from the other phases. In addition, a final producibility and cost analysis will be performed.

Because of the new manufacturing processes being investigated and the reproducibility of the radome, the overall cost of the radome will be lowered while quality will be increased.

This program is part of the Advanced Fighter Initiative.

"...to establish reproducible and affordable processes for composite multifunctional radomes..."

Accesion For	
NTIS CRA&I	☑
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and / or Special
A-1	

Project Engineer:
Diana Carlin
WL/MTPN
(513) 255-7277

Contract Number:
F33615-93-C-4312

For more information, circle Reader Reponse Number 2

Coating Systems To Reduce Cost, Weight, Improve Application Performance

Wright Laboratory's Manufacturing Technology (MT) Directorate recently awarded a classified $3.5 million contract to MSNW Inc. of San Diego, Calif., to optimize low-cost application techniques for oxidation resistant coating applications. MSNW will analyze and optimize radar-absorbing material coatings for both manrated and nonmanrated applications.

In this program, MSNW's tasks will include ensuring producibility, weight effectiveness, life-cycle durability, inspectability, and repairability of the coating system. They will also seek to reduce the cost and weight of the system while improving performance. This project is unique because all coatings and manufacturing techniques developed are nonproprietary. Under this agreement, the Air Force retains control of coating and manufacturing technologies developed easing its ability to transition the technology while still achieving lower cost.

In this 36-month, three-phased effort, MSNW and subcontractors Hughes Missile Systems Company, Williams International and Allison will, in the first phase, evaluate current coatings and application techniques. These coating systems will be examined using both thermal-chemical and thermal-mechanical analyses.

Important to the first phase of this project will be testing the compatibility of the different coating constituents and the substrate materials. This will determine how engineers optimize the materials and application processes to produce the best uniform coating on the substrate material.

In down selecting to two coating systems for both manrated and nonmanrated applications, engineers will specifically analyze the coatings high temperature capability, performance, durability and electro-magnetic performance.

In the second phase, MSNW will continue to optimize application processes to ensure performance goals are met. At the end of this phase, they will down select to one coating system for each application.

In the final phase, the selected coating system will be used to apply the radar-absorbing material to aircraft parts for testing and evaluation. Because this project will provide the Air Force with a generic coating system, many of the coating and application techniques being developed will have high potential for use throughout the Department of Defense.

This project is part of the Advanced Fighter Initiative, which is addressing affordability and reproducibility issues associated with advanced technologies.

"...optimize low-cost application techniques for oxidation resistant coating applications."

Project Engineer:
Ken Ronald
WL/MTPN
(513) 255-7278

Project Number:
F33615-93-C-5309

For more information, circle Reader Reponse Number 3

New Casting Technology To Improve Engine Performance

A $6.5 million contract recently awarded by Wright Laboratory's Manufacturing Technology (MT) Directorate will improve the technology for the very thin walled casting of nickel-based alloys.

Pratt & Whitney of West Palm Beach, Fla., along with Allison Engine Co., Indanapolis, Ind., will examine ways to take advantage of improvements in aircraft engine component design and materials capabilities. Engineers will cast a single crystal, one-piece transition duct segment at a minimum thickness of 0.010 inches for the F119 advanced fighter engine. Single crystal process affords higher temperature capability and greater performance.

Engineers have made significant technical progress toward the advancement of the propulsion system for the next generation aircraft. Innovative designs and new materials throughout the engine core have enhanced the future fighter's mission capability. However, without revolutionary new materials at affordable prices, there can only be small incremental advancements in the future. At the same time, to meet future mission goals the advanced fighter aircraft has to be lighter and faster. To reach this goal, weight must be taken out of all components, including the engine.

One problem facing aircraft engine manufacturers is the necessity to over design components because of current casting limitations, which results in excess weight. Many times components have to go through several manufacturing steps to complete their fabrication. Also, post-processing methods are needed to manufacture and complete the component to reach required specifications, which in many instances adds cost.

This revolutionary ultra-thin casting process to produce components is breaking down barriers, reducing part counts and weight by eliminating all but one manufacturing step. An entire family of components featuring thin-wall shapes offers significant potential to enable advanced propulsion system designs meeting new performance requirements.

This casting technology has already been demonstrated, but with this contract, engineers will address more complex shapes, such as twists, with high dimensional accuracy. By using thin-wall casting technology, the transition duct segment will become one integral part instead of 69 separate parts. This ability to cast all of the details reduces secondary operations from six to two. It is anticipated that 15 pounds will be eliminated from each engine when this technology is applied to the entire transition duct of the F119.

The program will be conducted in two phases with an optional third phase effort. Allison will conduct processing trials using their cast cool process. They will also demonstrate new manufacturing technology on selected components for an engine test.

The project will stimulate a robust manufacturing base supporting Air Force requirements, reduce prices and support rapid technology insertion. This project has a vast amount of technology transfer potential to the commercial manufacturing industry. It is part of the four-program Advanced Fighter Initiative which addresses affordability and reproducibility issues associated with advanced technologies concerning the advanced fighter aircraft.

Project Engineer:
Siamack Mazdiyasni
WL/MTPM
(513) 255-3612

Project Number:
F33615-93-C-4305

For more information, circle Reader Reponse Number 4

MT Shows Off Top Projects At NASA Conference

The NASA Technology 2003 Technology Transfer Conference has grown into a major forum for transferring leading-edge technologies to new commercial markets. In the midst of 7,000 attendees and 250 exhibitors, Wright Laboratory's Manufacturing Technology (MT) Directorate showcased its top projects.

Under NASA sponsorship, this event has tripled in size since its inception in 1990. This growth has come as both the government and industry have embraced technology transfer as key to economic growth. With this in mind, MT's display highlighted many manufacturing technologies available to industry.

In addition to more than 250 exhibitors in 40,000 square feet of exhibition space, the technical conference featured more than 100 symposia presentations by government technologists spotlighting commercially promising research innovations in critical areas, such as manufacturing, electronics, computing, materials, biotechnology, and environmental technology.

The conference opened with a session on defense conversion and the technology reinvestment project. The second day plenary session featured a workshop on "How to Successfully Tap into the Government's Technology Bank." Other workshops included an International Technology Transfer Forum,"Precision Casting Technologies for the Next Century" and "How to Successfully Market to the Federal Government."

The symposia featured presentations on the following topics: advanced manufacturing; computer hardware; environmental technology; materials science; photonics; artificial intelligence; biotechnology/medical; computer-aided design and engineering; test and measurement; video/imaging; information management; power and energy; robotics; virtual reality/simulation and computer software.

Technology 2004 will be held in Washington, D.C., at the Washington Convention Center Nov. 9-11.

MT Leaders Outline Future Projects, Goals At 25th Defense Manufacturing Conference

Leaders from the government, industry and academia recently addressed pressing issues during the 25th Anniversary of the Defense Manufacturing Conference held at the San Francisco Hilton. More than 700 attendees participated in the conference, which included technical sessions, tutorials, general session and exhibits.

With the theme of "Integrating the Manufacturing Base," several engineers from Wright Laboratory's Manufacturing Technology (MT) Directorate played key roles in defining the post-Cold War conversion of military technology to commercial use. With this theme in mind, Dr. William Kessler, MT director, provided insight on how the directorate will support the Manufacturing Science and Technology Program's affordability issues and other important initiatives affecting the directorate.

Also, emphasizing this year's theme was government keynote speaker, Anita Jones, director, Defense Research and Engineering, who spoke on future directions for the Department of Defense's Manufacturing Science and Technology Program, specifically the manufacturing technology efforts.

Dr. Paul Kaminski, industry keynote speaker, spoke on the progress of U.S. manufacturing in the areas of computer-integrated manufacturing and productivity.

Other MT people were involved in the technical sessions. Debra Haley of the Business Integration Office was the moderator of the Technology Transfer Sessions. She also provided a closer look at the directorate's technology transfer program, specifically how MT has emphasized transitioning technology to industry, promoted development of dual-use technology, and informed industry of new technological opportunities.

In the Lean/Agile/Flexible Manufacturing Technical Session, Nitin Shah of the Industrial Base Analysis Division discussed the Lean Aircraft Initiative, and how it will infuse production principles, concepts, and practices into the defense aircraft industry.

Richard Remski of the Electronics Division was the moderator of the Electronics Technical Session while Bruce Rasmussen of the Integration Technology Division moderated the Integrated Product/Process Development Technical Session.

Outlining the Manufacturing 2005 initiative was Tracy Houpt of the Industrial Base Pilot Integrated Product Team. His briefing discussed how the strategy will accelerate the deployment of newly developed manufacturing technologies and advanced practices, such as integrated product and process development, variability reduction, and commercial-military integration.

The Virtual Manufacturing/Simulation/Rapid Prototyping Technical Session was moderated by Michael Hitchcock of the Integration Technology Division. In this session, Daniel Lewallen briefed on Virtual Test, which has a goal of accelerating the Test Program Set tools.

Robert Neff of the Processing and Fabrication Division was the moderator of the Composites Technical Session.

MT highlighted its latest technology with two displays in an exhibit hall, which featured more than 50 exhibitors. This provided an opportunity for attendees to learn more about MT initiatives, including the Defense Production Act Title III.

Plans for 1994's conference are already under way. Sponsored by the Air Force, it will be held Nov. 28-Dec. 1 at the Pointe Hilton, Phoenix, Ariz. For further information call the DMC Registration Desk (513) 426-2808.

Dr. William Kessler

Title III Program Keeps Production Of High Quality Silicon In U.S.

Production of a special silicon material vital to the manufacture of infrared and laser seeker detectors, vidicons, and high-power switching devices will start soon in the United States because of a recently awarded Defense Production Act contract.

Managed by the Title III Program Office of Wright Laboratory, a $12 million fixed-price contract was awarded to Unisil Corp. of Mountain View, Calif., for the production of high purity float zone single crystal silicon. Wright Laboratory's Materials and Aero Propulsion and Power Directorates are technical sponsors of the 66-month project.

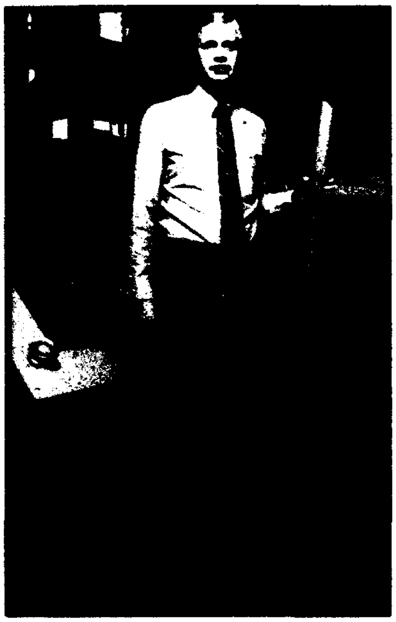
To be effective for certain military and commercial applications, the silicon material must be of higher purity and quality than silicon needed for even the most advanced integrated circuits. In this particular case, the purity is 10 to 100 times greater than normal. This purity is achieved by using radio frequency energy to heat purified silicon to a molten state allowing impurities to flow to the top. Currently, there are no domestic producers of high purity float zone silicon. "The last U.S. supplier exited the market more than 10 years ago," said John Blevins, Title III project engineer.

Like most Title III projects, this effort is unique in that it seeks to establish a viable continuing industrial capacity to supply defense and commercial need beyond the production of this special silicon. Unisil has agreed to share the costs and risks of establishing a domestic production capability because the government has committed to purchasing 2,000 kilograms of silicon. As Unisil sells the silicon to other users and establishes a market, the government commitment is reduced.

The Defense Production Act Title III is a Department of Defense program which seeks to maintain or develop industrial production capacity to support critical defense needs. The program offers U.S. companies incentives to enter and remain in production. Incentives which Title III programs can offer industry include direct purchases, purchase commitments or loan guarantees. These incentives give companies a helping hand in getting on their feet to compete in the world market place, while providing materials for defense programs.

According to Pat Hemenger of the Materials Directorate, "The directorate is enthusiastic about this program because we have invested considerable resources demonstrating the value of high purity silicon to the Air Force and developing processes for its manufacture. The Title III Program is carrying this new material into the national technology base where it is readily available for dual use in critical Air Force systems and the newest commercial products."

Wright Laboratory's Manufacturing Technology Directorate is the DoD Executive Agent for managing the Title III program.



Project Engineers:
John Blevins
WL/MTD
(513) 255-3701 Ext. 226

Pat Hemenger
WL/MLPO
(513) 255-4474

Contract Number:
F33733-94-C-1014

For more information, circle Reader Reponse Number 5

Program Lowers Cost Of Special ICs

Electronic equipment used on space and military missions requires integrated circuits (ICs) that can withstand harsh environments, including those with extreme radiation. Devices with this type of radiation tolerance have been demonstrated using silicon-on-insulator (SOI) technology, but the manufacturing process still needed many refinements to lower production costs and improve device quality.

Under a contract with Wright Laboratory's Manufacturing Technology Directorate, Texas Instruments of Dallas, Texas, was able to lower the cost of SOI substraits to around $100 per wafer--a cost reduction of about 50 percent. Their engineers were also able to increase the complexity of ICs fabricated on SOI.

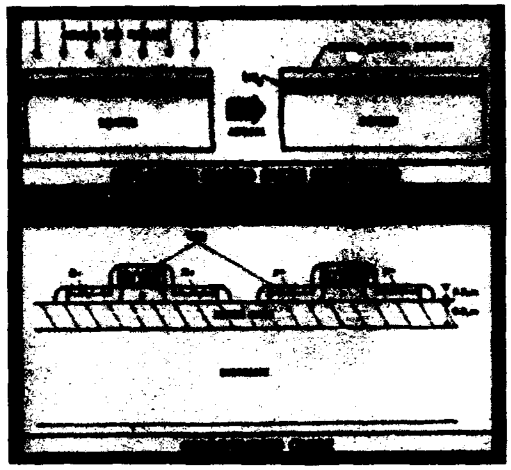
They used the Separation by Implantation of Oxygen (SIMOX) technique, which produces SOI material based on silicon substrates. One advantage to this process is silicon substrates are commonly used, and their characteristics are already known in the semiconductor industry.

SOI was first demonstrated using silicon-on-sapphire (SOS) wafers to fabricate radiation hardened IC devices. The problem with using SOS wafers is the lack of a supply of high quality, low cost material. SIMOX technology does not have this problem. With the technology developments in the SOI program, the Department of Defense will have available state-of-the-art, large area radiation hardened ICs at reduced cost.

During this program, IBIS of Danvers, Mass., started to produce and sell SOI wafers to the semiconductor industry, which was one of the integral goals of this project. IBIS is producing SIMOX wafers on a high throughput NV-200 ion implanter, which minimizes the wafer implantation time and reduces wafer cost by mechanizing the batch processing.

This program exceeded all expectations by producing a complex 256K bit static random access memory (SRAM) device, instead of the 16K originally planned in the contract. Yield on the demonstration wafers was 14 percent compared to the contract requirement of two percent.

During this program, engineers reduced the cost of producing SOI wafers with the SIMOX approach, and they developed new and improved processing techniques. Devices produced by SIMOX can use less power and operate faster and at higher temperatures than devices produced with bulk silicon. These characteristics, though valuable in military systems, also make the improved ICs attractive for use in many commercial applications. They are expected to have high potential for commercial technology transfer and transition into other DOD applications.



Project Engineer:
lst. Lt. Richard Haywood
WL/MTEC
(513) 255-2461

Project Number:
F33615-89-C-5714

For more information, circle Reader Reponse Number 6

IPD Approaches Used To Develop A Low-Cost Composite Transport Fuselage

The first phase of a three-phase effort under the Design and Manufacture of Low Cost Composite (DMLCC), Fuselage contract was recently completed. This phase was one of the most innovative and unique projects sponsored by Wright Laboratory's Manufacturing Technology (MT) and Flight Dynamics Directorates.

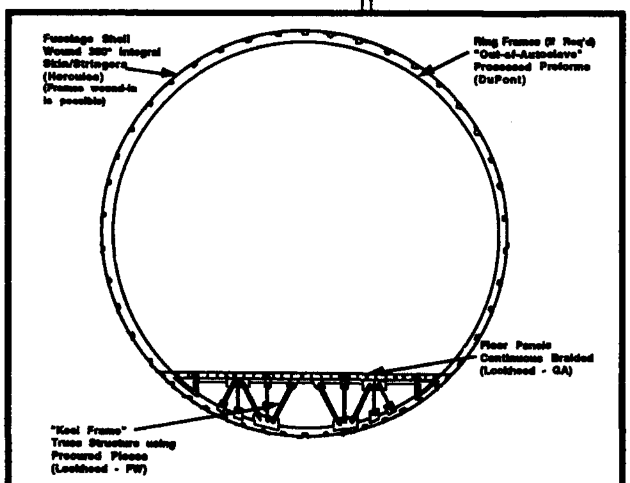
Manufacturing costs reduced by 61 percent.

Supportability costs reduced by 58 percent.

The project was innovative because a team made up of 50 members representing five major companies located in different areas of the United States used an integrated product development (IPD) approach to design a composite transport fuselage. It was unique because of all the electronic data being passed between members who analyzed four different fuselage concepts before selecting the one-piece design.

The program was part of a four-project DMLCC initiative. The fuselage program was a team effort headed by Boeing Defense and Space Group of Seattle, Wash., and included team members from Lockheed Georgia, Lockheed Fort Worth, Hercules and DuPont. A product development team approach was used to ensure that all functional concerns received consideration early in the design of the fuselage.

Using IPD approaches, the goal of the DMLCC initiative was to develop integrated design and manufacturing technologies that reduce acquisition costs associated with composite structures by 50 percent while reducing supportability costs by 25 percent.



For the fuselage program of this initiative, this goal was significantly surpassed. By using the Boeing composite cost model, the interface control group determined the one-piece composite fuselage would reduce manufacturing costs by 61 percent compared to the baseline fuselage with an additional savings of 58 percent in supportability costs.

This 18-month effort started by designing a YC-14 composite fuselage using today's technology and manufacturing approaches as a baseline. This process was necessary because no composite fuselage is being built today. A thorough cost analysis provided engineers the baseline needed to complete the project.

After brainstorming sessions and analyzing more than 250 ideas, engineers decided to attack the problem by designing four different fuselages. These fuselage designs were drawn and accompanied by a detailed manufacturing and tooling plan. The data was used as the input to the composite cost model for calculation of the acquisition costs. The cost analysis and

strategy assessment model was used to calculate supportability and life cycle costs.

The team's first concept examined a four quadrant approach in assembling the 20-foot fuselage. This concept required assembling four sections into one fuselage. Engineers examined three distinct designs under this concept, making the total designs analyzed for the program seven.

A honeycomb approach was used in the second concept design. This approach had two quadrants of 185 degree sections, which were then assembled into one fuselage.

The third concept was based on three quadrants using a thermoplastic composite. Though this design did not reach cost goals, the concept was innovative in its use of thermoplastic material.

The selected fourth concept design is a one-piece totally integral composite fuselage which is accomplished in one "shot." The fuselage will require no fasteners nor major final assembly activities. The floor structure is simply built inside the fuselage section using truss members and gussets. It uses rod packs developed on the DMLCC bonded wing program to stiffen the fuselage stringer caps. It was a thoroughly innovative design and pushed manufacturing technology approaches to their limits.

The successful completion of the first phase did not come without heartaches and valuable lessons learned. Some of these include:

- ⇨ Efficient data transfer is the real key to success.
  - O The most efficient data transfer system would be all team members using the same computer and software systems, but this will never happen.
  - O Faxing, conference calls and over nighting computer disks become the way of life.
  - O Configuration management is vital to make sure the most current changes are being incorporated.
- ⇨ There are no short cuts.
  - O All team members must be involved.
  - O Team members must have the authority to make decisions at their level.
- ⇨ The team must function as one.
  - O Team members must listen to opinions.
  - O Trust among team members is vital.
  - O All ideas must be considered and evaluated.

Although no structure has been built, every detail was documented so all of the IPD processes and information developed are available for other programs.

Project Engineers:
Diana Carlin
WL/MTPN,
(513) 255-7277

Dick Holzwarth
WL/FIBAC
(513) 255-6639

Contract Number:
F3615-91-C-5716

For more information, circle Reader Reponse Number 7

Industrial Base Analysis Finds Problems, Saves DOD Money

Since the end of the Cold War, the Department of Defense has gone through many adjustments. This same environment has also caused mammoth upheaval in the defense industrial base the Air Force relies on to support weapon systems. In all aspects of business, U.S. defense contractors are now feeling the pinch. As bad as the financial hardship has been on prime contractors, the real impact is to the industrial base's lower tiers, who do not have the resources to make up production shortfalls.

The business health of these lower tier industries is vital in the Air Force's effort to provide and support superior weapon systems. In this environment, it is essential that the Air Force identifies and validates program risks. Wright Laboratory's Manufacturing Technology Directorate is doing just that by examining Air Force program risks for lower level contractors. To provide Air Force program managers with up-to-date information, the directorate's Industrial Base Analysis Division uses a variety of analysis tools to identify risks.

The business health of these lower tier industries is vital in the Air Force's effort to provide and support superior weapon systems.

The important role of industrial base analysis was dramatically highlighted in a recently completed analysis of the satellite industry, which showed how fragile lower-tier contractors are in this downsizing environment.

Working hand-in-hand with program managers from the Space and Missile Systems Center, Los Angeles AFB, Calif., industrial base personnel analyzed the industrial base supporting the Titan IV missile. Results from this study, later confirmed in upper and lower tier satellite industrial base analyses, showed that more than one-third of the supporting contractor base was classified at high or medium risk. What this meant was, within five years, these contractors would probably not be able to provide the parts they now supply the Air Force.

The benefit of the analysis to these programs was not that it could solve all the industrial base problems, but it identified what problems existed. In the studies of the lower tiers, a number of issues were uncovered that could have caused major program cost and schedule impacts.

For example, the division discovered that a third-tier contractor, Rohr Industries, had a number of medium risk items in the Titan IV solid rocket motor from an environmental standpoint. The resin system used for the insulation case bond on the solid rocket motor was classified as high risk due to problems at the sources.

Industrial base analysis found that all three suppliers to Rohr said that their chemical products were a high environmental risk, and these suppliers might discontinue manufacturing them in the next two years because of Environmental Protection Agency restrictions.

By following up other leads, directorate personnel found the problem was much worse than expected. One of the suppliers, R.F. Vanderbilt, was the sole distributor of the antioxidant, agerite white, and relied on a sixth-tier supplier B. F. Goodrich. The EPA had banned agerite white and B. F. Goodrich was ordered to shut down production of the chemical in 90 days. The prime and upper tier suppliers had no knowledge of this order.

When industrial base analysis notified the Titan IV program director, he took prompt action. The Titan IV program arranged a lifetime buy of agerite white to complete the contract. If the Air Force had not purchased the chemical, it would have delayed the contract up to three years and cost the Air Force several million dollars to find an alternative way to build and test fire at least two solid rocket motors to requalify the system.

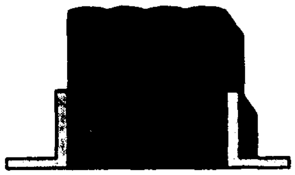
Because of this cost savings and other successful results of the analysis, the Space and Missile Center commander urged all space system program managers to use the lower tier industrial base analyses as an effective risk management tool. With this type of command support, the directorate's goal is to institutionalize the industrial base analysis process into all Air Force programs, giving managers a vital tool.

As demonstration of their commitment to this process, Air Force program mangers provided $740,000 of their program funds to continue the lower tier satellite systems analysis.

Project Manager:
Edward Gordon
WL/MTAS
(513) 255-3701, ext. 241

For more information, circle Reader Reponse Number 8

Reports



Advanced Capability Exhaust Systems/ Integrated Product Development for Advanced Nozzles

Alog Number: 3293
Contract Number: F33615-91-C-5733
Technical Report Number: WL-TR-93-8030
Distribution: UNLIMITED

Automated Airframe Assembly Program

Alog Number: 1808
Contract Number: F33615-87-C-5217
Technical Report Number: WL-TR-92-8019
Distribution: LIMITED

Design and Manufacture of Low Cost Composites, Bonded Wing Phase I

Alog Number: 3064
Contract Number: F33615-91-C-5729
Technical Report Number: WL-TR-93-8009
Distribution: LIMITED

Intelligent Distributed Measurement System

Alog Number: 85
Contract Number: F33615-89-C-5719
Technical Report Number: WL-TR-92-8006
Distribution: LIMITED

Development of a Rotor Stacking Process Cell for Gas Turbine Engines

Alog Number: 1366
Contract Number: F33615-82-C-5093
Technical Report Number: WL-TR-92-8042
Distribution: LIMITED

Videos

ManTech for Powder Processed Blades and Vanes

Alog Number: 28
Length: 22:00
Distribution: UNLIMITED

Feature-Based Assembly Modeling

Alog Number: 18
Length: 18:45
Distribution: UNLIMITED

Advanced Tooling forComposite Structures Phase I

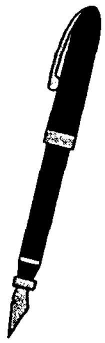
Alog Number: 9
Length: 27:55
Distribution: UNLIMITED

Software

Management Planning And Control System (MPCS) (Data Cassette 1 of 1) -August 1989

Format: UNIX
Alog number: MT019
Installation Tape

Ordering Information



In order to obtain any items listed, or any documents maintained by the Technology Transfer Center, the following information is needed:

Reports

A written request on company letterhead which contains:

- Title of Document, Contract Number, or Technical Report Number.
- Purpose of request.
- Signature, typed name, title, and mailing address.

If requesting a document that has LIMITED distribution, contractor certification is required. Contact the Defense Logistics Service Center (DLSC) at 1-800-352-3572 to verify your certification.

Videos

A written request on company letterhead containing:

- Title of video.
- Purpose of request.
- Signature, typed name, title, and mailing address.
- Provide a blank VHS video tape.

Software

A written request on company letterhead containing:

- Title of video.
- Purpose of request.
- Signature, typed name, title, and mailing addredss.

Contractor certification is requried.

After receiving your request, a Statement of Terms and Conditions form will be mailed to you. Fill out in full and return with a blank 9 track, 16 b.p.i., 2400 fett reel (10 inch tape).

Send all requests to:

ManTech Technology Transfer Center
Attention: Christy Ahrens
WL/MTX -- Building 653
2977 P. Street, Suite 6
Wright-Patterson AFB, OH 45433-7739
Phone: (513) 256-0194
Fax: (513) 256-1422

END OF CONTRACT FORCAST

Date	Project Title Contract Number	Prime Contractor	Point of Contact
May 94	Rapid Thermal Processor for Cost Effective Manufacturing Active Matrix Liquid Crystal Displays F33615-92-C-5808	Aktis Corp. Rocklin, Calif.	Robert Cross (513) 255-2461
Jun 94	Premium Quality Titanium and Alloy Disk F33615-88-C-5418	General Electric Company Aircraft Engines Group Cincinnati, Ohio	Siamack Mazdiyasni (513) 255-2413
Jul 94	Knowledge Integrated Design System F33615-89-C-5619	Universal Energy System Dayton, Ohio	William O'Hara (513) 255-1995
Aug 94	High Resolution 3D Computed Tomography F33615-93-C-5327	Perceptics Corp. Salt Lake City, Utah	Charles Buynak (513) 255-9807
Sep 94	Application of Six-Sigma Design Concepts to Integrated Product/Process Development F33615-93-C-4328	Texas Instruments Inc. Defense Systems & Electronics Group Dallas, Texas	Ted Finnessey (513) 255-8589
Sep 94	Active-Matrix Pixel and Line Defect Detection Technology F33615-92-C-5809	Photon Dynamics Milpitas, Calif.	Robert Cross (513) 255-2461
Sep 94	A Laser-Based Metal Deposition and Material Removal System for High Definition Flat Panel Displays F33615-92-C-5807	Photon Dynamics Milpitas, Calif.	Robert Cross (513) 255-2461
Sep 94	Manufacturing Technology for High Voltage Power Supplies F33615-89-C-5704	Northrop Corp. Defense Systems Division Rolling Meadows, Ill.	P. Michael Price (513) 255-2461